## REOPERATIVE STERNOTOMY: MINIMIZING INJURY WITHOUT THE RISKS OF SYSTEMIC HEPARIN

**To the Editor:**

We read with great interest the November 2010 article by Park and colleagues[1] regarding the risk of injury during repeat sternotomy for heart surgery. In their experience of 231 patients, 267 injuries (9%) occurred. The in-hospital mortalities were 6.5% among those without injury and 18.5% among those with injury ($P < .001$). When the injury was sustained during sternal division, the mortality was 25%.

Cardiac reoperations are challenging, are time-consuming, and carry a high incidence of perioperative complications because of injury associated with cardiac structures (bleeding and hemodynamic instability). This study offers an important clinical message, highlighting the deleterious effects of reoperative sternotomy. Some centers are using extracorporeal circulation with heparinization[2] at the time of resternotomy, but this leads to prolonged anticoagulation, platelet dysfunction, fibrinolysis, coagulopathy, and morbidity.

We[3] routinely perform resternotomy in complex cardiac surgery with the support of heparin-free cardiopulmonary bypass but with a heparin-bonded circuit (Carmeda; Medtronic, Inc, Minneapolis, Minn). The femoral artery or axillary artery and femoral veins are cannulated before the sternotomy, and cardiopulmonary bypass is instituted with a "tip to tip" heparin-bonded circuit but without systemic heparinization. Systemic heparin (200–300 units/kg) is administered only after all structures have been isolated before aortic crossclamping (activated coagulation time longer than 400 seconds). Between 1996 and 2008, a total of 336 patients underwent reoperative sternotomy with heparin-bonded circuits for complex cardiac procedures (isolated reoperative coronary artery bypass grafting procedures were excluded in this study), with only 29 deaths (8.6% mortality). Only 5 of these 336 patients (1.5%) sustained injury to the right ventricle, aorta, or bypass graft or had ventricular fibrillation during reentry; all were without hemodynamic deterioration and had both uneventful repair and outcome (no deaths). There were no cases of online heparin-bonded circuit thrombosis. Heparin-bonded circuits without systemic heparinization during resternotomy thus can be used safely in complex reoperative surgery. The heart is completed decompressed during the resternotomy, allowing easy dissection, decreasing the likelihood of injury to vital structures, and lessening bleeding without compromising the hemodynamics. This technique should be included in the armamentarium for complex reoperative cardiac surgery.

*Arun K. Singh, MD*
*Gary Stearns, CCP*
*Andrew Maslow, MD*
*William C. Feng, MD*
*Carl Schwartz, MD*
*Division of Thoracic and Cardiovascular Surgery*
*Department of Anesthesiology*
*The Warren Alpert Medical School of Brown University*
*Rhode Island Hospital*
*Providence, RI*

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### References

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doi:10.1016/j.jtcvs.2010.11.049

**Reply to the Editor:**

My coworkers and I greatly appreciate the letter by Singh and colleagues concerning our recent study focused on the risks of repeat median sternotomy. Their results are clearly outstanding, and their application of heparin-bonded circuits "tip to tip" is intriguing. Their technique appears to have had a definite impact on the risk of injury during repeat sternotomy. Although we have not used this particular technology, we have more frequently used full cardiopulmonary bypass under full heparinization before performing sternotomy in recent years. As has been argued by others, we find that this approach speeds us along and does not seem to increase bleeding. It is certainly easier on our own coronary vasculature, and we agree that surgeons should take a long, hard look at means of reducing the risk of injury. Injury is not inevitable. It can be minimized.

*Thoralf M. Sundt III, MD*
*Division of Cardiovascular Surgery*
*Mayo Clinic and Foundation*
*Rochester, Minn*

doi:10.1016/j.jtcvs.2011.01.001

## EIGHT YEARS AFTER AN EARLY PRIMARY KAWASHIMA OPERATION

**To the Editor:**

In a previous article in the *Journal,* published 6 years ago,[1] we reported a successful fenestrated Kawashima operation with antegrade pulmonary